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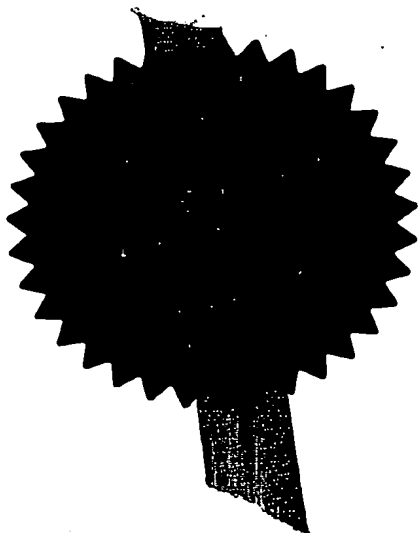
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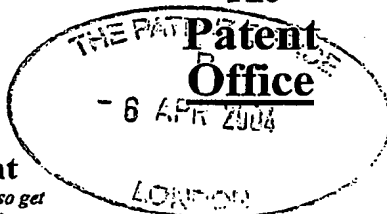


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BRITISH TELECOMMUNICATIONS public limited company
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Registered in England: 1800000

Patents ADP number (if you know it)

1867002

If the applicant is a corporate body, give the country/state of its incorporation

UNITED KINGDOM

4. Title of the invention

INFORMATION RETRIEVAL

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1867001

08772378001

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Country

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Description

13

Claim(s)

2

Abstract

1

Drawing(s)

2 + 2 *Jan 2*

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Priority Documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

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INFORMATION RETRIEVAL

The present invention relates to an information retrieval apparatus and method.

According to a first aspect of the present invention there is provided a method for accessing an information resource, comprising the steps of:

- (i) receiving a user query;
- (ii) comparing portions of the user query with phrases in a set of predefined phrases to find one or more matching phrases;
- (iii) identifying, using predefined relationships between said predefined phrases and predefined concepts in an ontology, one or more concepts relevant to said portions of the received user query; and
- (iv) identifying, using predefined relationships between predefined actions and said predefined concepts, one or more actions relevant to the received user query, wherein an action comprises providing access to an information resource.

Preferably, said predefined concepts comprise task concepts and non-task concepts, and the ontology defines, for each task concept, an indication of the number of non-task concepts required to implement a corresponding task.

In a preferred embodiment of the present invention, there is provided a further step:

- (vi) in the event that said one or more concepts identified at step (iii) are insufficiently specific to enable a relevant action to be identified at step (iv), identifying from the ontology one or more further concepts related to those identified at step (iii) and requesting input from a user to select one or more of said further concepts for use in step (iv) to identify a relevant action.

Apparatus according to the present invention may be applied as a "just-in-time" information assistant which uses an ontology to improve the management and selection of information to be displayed to a user. In addition to supplying information, preferred embodiments of the present invention enable user queries to be linked to business processes and people. For example, in a contact centre application the apparatus accepts an incoming message, e.g. an operator dialogue with a customer or an email, and matches the message to concepts in the ontology. Combinations of these matched concepts are then used to show information, select a business process or locate a relevant person.

The ontology is a representation of relevant entities along with important properties and their relationships. For example the products supplied by a company are the relevant entities whilst information about which are EEC compliant are important properties. In preferred embodiments of the present invention the ontology is implemented as a hierarchy in which child nodes are instances of a parent node. The ontology enables reuse of defined concepts for different domains of application and enables task-related concepts, e.g. fault, pricing information, to be identified separately from entities such as product types.

It is not just documents which can be attached to entities in the ontology, but also processes and people. A call centre operator for example may therefore be directed more quickly to the correct response in respect of a customer enquiry, i.e. relaying a piece of information, activating the correct business process or contacting the correct person.

Two interactive modes of operation of the apparatus are supported according to preferred embodiments of the present invention: in one mode the apparatus is able to carry on a dialogue with a user in order to resolve a query that is too broad; in another mode the apparatus may monitor telephonic or instant messaging conversations between a customer and a call centre operator, for example, analysing the conversation to continuously identify key concepts in the conversation and to construct relevant queries to automatically supply information, identify processes or people relevant to the subject matter being discussed with the customer.

Preferred embodiments of the present invention use an ontology:

- (1) To organise resources such as documents, business processes and domain experts. It effectively provides a concept-based indexing to these resources. As the ontology is formal and highly structured, it allows fast and accurate resource retrieval using structured queries instead of merely generating a list of hits as is often returned by known answer engines.
- (2) To help analyse the correct intention of a user query. The invention's dialogue module uses relationships and constraints for each of the defined concepts to ascertain relevant tasks which may apply.

Fuzzy techniques are used to map concepts in the ontology to words and phrases likely to arise in user queries and hence to handle the idiosyncrasies and unstructured nature of user queries.

According to a second aspect of the present invention there is provided an information retrieval apparatus, comprising:

an input for receiving a user query;

an ontological database for storing an ontology defining relationships between a plurality of predefined concepts;

a context phrase database for storing predefined context phrases and, for each context phrase, information defining a fuzzy relationship with an associated concept stored in the ontology;

a concept mapper for comparing portions of a received user query with context phrases stored in the context phrase database to thereby identify and output one or more relevant concepts; and

an action selector operable to identify an action in respect of one or more relevant concepts output by the concept mapper, wherein an action comprises providing access to an information resource in response to the received user query.

Preferred embodiments of the present invention will now be described in more detail, by way of example only, with reference to the accompanying drawings of which:

Figure 1 is a diagram showing features of an apparatus according to preferred embodiments of the present invention; and

Figure 2 is a flow diagram showing steps in operation of a fuzzy concept mapper according to a preferred embodiment of the present invention.

A preferred apparatus and its operation according to a preferred embodiment of the present invention will now be described in overview with reference to Figure 1.

Referring to Figure 1, the apparatus 100 is provided with a query input 105 arranged to receive a query from a user. Of course, a user query need not be an actual question. In a preferred call centre application of the present invention, it may be appropriate simply to ensure that relevant information is always available on-screen to the call centre operator (user of the apparatus 100) while processing a customer enquiry. On receipt of a new query at the query input 105 a new query session is initiated within the apparatus 100. The query input 105 is arranged to receive a user query by a number of different channels. For example, the query may be received in the form of an e-mail message or as a natural language query submitted by means of a web page or an instant messaging interface. Alternatively, speech recognition software may be used to convert a user's spoken dialogue into a text input to the query input 105, in real time, for processing by the apparatus 100 as the dialogue progresses.

Once a query text has been received at the query input 105, or while text is being received, it is passed to a so-called "phrase chunker" 110. The phrase chunker 110 separates input queries into smaller chunks, i.e. phrases which can be matched to

concepts. Preferably, the phrase chunker 110 is arranged to divide the received query text into n-grams - sequences of n words or fewer, ideally with $n < 5$ - wherein an n-gram does not cross a sentence boundary. Alternatively, the phrase chunker may operate according to a known yet more sophisticated algorithm, designed to identify phrases of up to a predetermined length comprising words more likely to be indicative of the concepts embodied in the user query, eliminating certain "low value" words before constructing those phrases for example.

Output from the phrase chunker 110 is submitted to a fuzzy concept mapper 115 operable to identify one or more predefined concepts stored in an ontology database 120 that appear to have the greatest relevance to terms and phrases output from the phrase chunker 110. The fuzzy concept mapper 115 identifies concepts by firstly looking for context phrases stored in a context phrase database 125 that match terms and phrases contained in the query input. Predefined fuzzy relationships are maintained between concepts stored in the ontology database 120 and context phrases stored in the context phrase database 125. Therefore, having identified one or more matching context phrases (125), the fuzzy concept mapper 115 is able to identify one or more relevant concepts by analysing the respective fuzzy relationships. A more detailed description of the operation of the fuzzy concept mapper 115 will be provided below.

The fuzzy concept mapper 115 is arranged to generate and to update a list of the current concepts identified in a received user query at any one time. For example, if the user query is being captured from dialogue, the fuzzy concept mapper 115 is arranged to continually look for relevant concepts as query text is received (105) and processed by the apparatus 100, to add newly identified concepts to the current concept list and to update fuzzy support values (relevance weightings) associated with those concepts already identified. It is therefore important that when a new user query is received at the query input 105, or when it is otherwise determined that the apparatus 100 should be reset with respect to an ongoing user query, that the list of current concepts is emptied.

The fuzzy concept mapper 115 looks in the ontology (120) for relevant concepts of two types: task and non-task. The ontology (120) defines for each task concept the number and type of non-task concepts that would be required to fully define the task. The fuzzy concept mapper 115 is therefore arranged to recognise an event in which a task concept and a required number of non-task concepts has been identified in respect of a given user query and, at this point, to output the current

tion relationships. Concepts are preferably arranged in a hierarchical fashion so that a given concept typically comprises a parent concept and a set of one or more child

concepts. Preferably, the ontology distinguishes task concepts from non-task concepts. Task concepts are abstract tasks, e.g. fault, sales, pricing, overview, etc. Each concept may have associated with it a set of one or more properties. In particular, a non-task concept may have a property that defines, for example, whether specific task concepts can be associated with it.

By way of example, a section of an ontology as may be stored in the ontology database 120 comprises a hierarchy of concepts, as follows,:

TASKS

- Describe_Benefits
- Pricing
- Buy
- Fault
- Reconnect
- Information
- Alter_details
- Compare
 - prices
 - features

PRODUCTS

- PHYSICAL-PRODUCTS
 - CORDLESS-PHONES
 - ANSWERING-MACHINES
 - FAXES
- INTERNET-ACCESS
 - DIAL-UP
 - MIDBAND
 - BROADBAND
- PSTN
 - Friends&Family

In this example, there are two types of concept in the ontology: "TASKS" and "PRODUCTS." The ontology is arranged in a hierarchical fashion with TASKS and PRODUCTS being the root nodes of the ontology. Each "child" node under the "parent"

information. A known algorithm may be used to extract key terms from an input

document and/or to suggest where in the hierarchy of the ontology (120) a concept should be placed and which context phrases should be associated with it.

For each concept defined in the ontology database 120 there is provided, in the context phrase database 125, an associated list of key phrases which are related to the concept. A fuzzy measure of support between 0 and 1 is recorded against each key phrase, indicative of the relevance of the phrase to the associated concept. For example, for the concept *task: fault:*, the relevant key phrases and measures of support that might be recorded in the context phrase database 125 are:

broken: 0.9

not working: 0.9

loose: 0.3

squeaky: 0.1

The context phrases selected for inclusion in the context phrase database 125 are those phrases most likely to be used in user queries. The context phrase database 125 therefore provides a link between terms that might be expected to occur in a typical user query and concepts defined in the ontology (120). This link is exploited by the fuzzy concept mapper 115 in order to identify, by comparing portions of a received user query that have been output by the phrase chunker 110 with stored context phrases (125), one or more concepts of greatest relevance to the received user query. Preferred steps in operation of the fuzzy concept mapper 115 for identifying one or more concepts of relevance to a new user query will now be described with reference to Figure 2. The process to be described may operate to analyse a user query that has been received complete, e.g. in the form of an e-mail, or to analyse portions of a user query as it is being received, e.g. during an ongoing conversation between a call centre operator and a customer.

Referring to Figure 2, the preferred process begins at STEP 200 by initialising the current concept list for the user query so that the process begins with an empty list, or a list comprising one or more default concepts with associated fuzzy support values. A portion of the user query is received at STEP 205 from the phrase chunker 110. At STEP 210 the received portion is compared with context phrases stored in the context phrase database 125. If, at STEP 215, no matching context phrases are found, then processing proceeds to STEP 250 to determine whether the end of the user query

list for the current task. If there are more than n other concepts in the list, the action

the resultant web page to the user. An action may be highly structured and represent a

choice must be made between broadband and mid-band in order to define what is

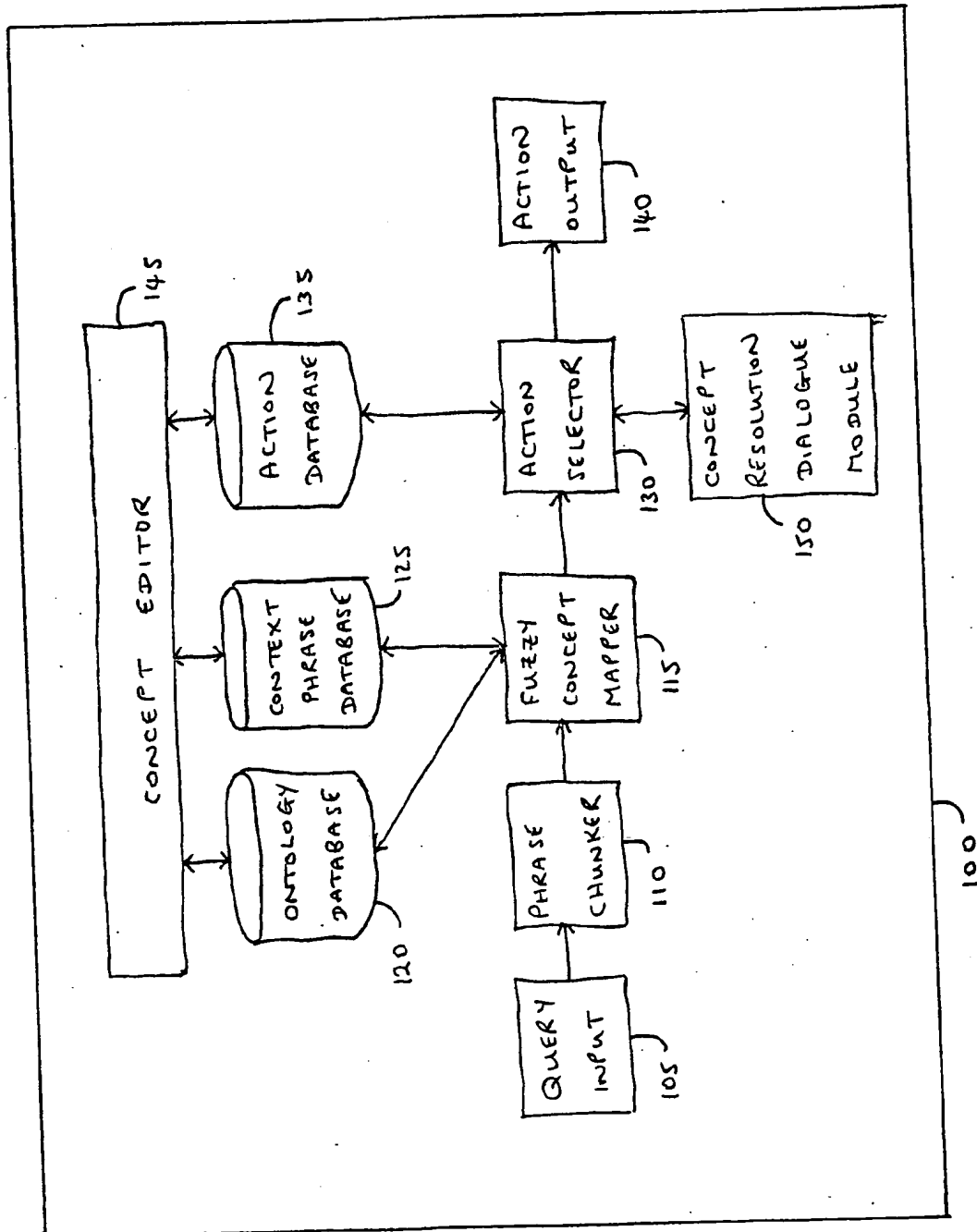


FIGURE 1

2/2

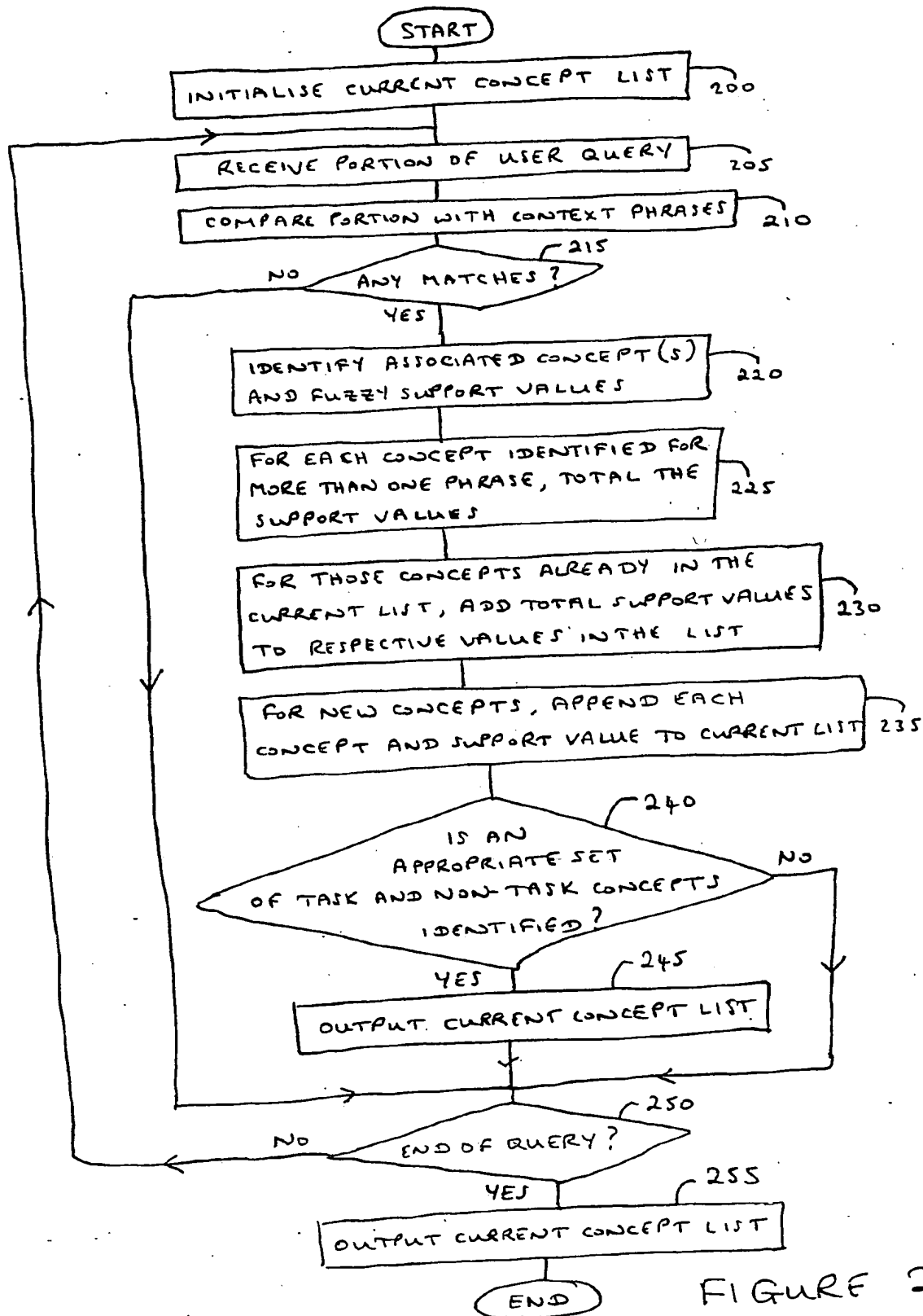


FIGURE 2

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| Date of mailing (day/month/year) 21 April 2005 (21.04.2005) | |
| Applicant's or agent's file reference A30476 WO | IMPORTANT NOTIFICATION |
| International application No. PCT/GB05/000937 | International filing date (day/month/year) 10 March 2005 (10.03.2005) |
| International publication date (day/month/year) | Priority date (day/month/year) 06 April 2004 (06.04.2004) |
| Applicant BRITISH TELECOMMUNICATIONS PUBLIC LIMITED COMPANY et al | |

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